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HINTS ON THE HYGIENE OF TRACHOMA AND  
THE INFLUENCE OF CLIMATE AND ALTI-  
TUDE IN ITS MANAGEMENT.<sup>1</sup>

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IN ORDER to establish efficient rules for the hygienic management of a disease we must first have some definite and well-defined ideas in regard to its cause, the condition of the subject and the environment most conducive to its development. In trachoma our knowledge in respect to some of these factors is sadly deficient. We have not yet arrived at a unanimous acceptance of a microbic origin of the disease. While the probabilities, in view of modern bacteriological studies, point to a specific micro-organism as concerned in some way in its development, the most diligent researches have failed to discover one which any considerable number of investigators agree upon as the special trachomatous microbe. It is contended, on the other hand, by others, that the disease

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<sup>1</sup>Read in Abstract before the Section of Ophthalmology of the American Medical Association held in Philadelphia, June 3, 1897.

is but an affection of the adenoid tissue of the conjunctiva set up by an inflammation of any origin whatever—traumatic or microbic—in an individual predisposed to that particular morbid process, and who is in a condition favorable to its outbreak. In other words, a commonly recognized specific agent for the causation of trachoma has not yet been discovered. Even its contagiousness, *per se*, which was formerly accepted as one of the chief characteristics of the disease, is now questioned by many. The inoculation of trachomatous material into a healthy conjunctiva has failed to produce the disease (Van Milligen). And while it is true that the discharge from an eye suffering from trachoma may, and undoubtedly has, caused an outbreak of the disease in an unaffected eye this is easily accounted for by the fact that these discharges contain micro-organisms which when transplanted to another eye will set up an inflammation, not however necessarily trachomatous, but which may lead to the development of trachoma in an eye predisposed to it. This matter of predisposition is one which has attracted any considerable attention only recently. In former times trachoma was looked upon as a purely contagious disease to which all persons were liable in nearly the same degree and this is the position held by quite a number to-day. The facts, however, which have been elicited by a systematic investigation of its prevalence among the different races have shown such a disparity of susceptibility among them that we are forced to consider race as an important factor in the development of the disease. This fact would establish the necessity of a predisposition, and constitute a dyscrasia, a most important element in the line of causation. Some races, as the negro in the United States, are practically immune, even amid the most unfavorable hygienic surroundings, while others, as the Irish, Polish Jews and Italians, are particularly liable and suffer greatly wherever they may be under circumstances at all favorable for its development.

With the acceptance of the theory of a dyscrasia or predisposition our ideas in regard to the hygienic management of trachoma must differ somewhat from those based on a theory of pure contagiousness. Unfortunately, the theory of a dyscrasia has been seriously considered only a short time and our knowledge of the nature of the predisposition is very limited. This is the field which promises a better return for labor and in-

vestigation than any other concerning this important disease. The clinical picture of trachoma, its result, its treatment, medicinal and surgical, have engaged the attention of surgeons almost exclusively up to a recent date. Its prevention has come in for a small share of their attention. We must remember that after all the chief function of our science is not so much to cure disease as to prevent it. To this end we must study the natural history of the disease with the conditions of the patient and his environment which are most favorable for its development. For this purpose comprehensive collective statistics from all parts of the world are necessary.

It must be borne in mind that here as well as in diseases of a demonstrated or suspected microbic origin we must have for the development of the pathologic process not only an active, but a predisposing cause. In the case of a microbic disease there must be not only the seed but also the soil in which it least grows and develops. Even in the healthy conjunctival sac we have always micro-organisms, and some of them have been found to be pathogenic when the condition for their development are propitious. Hitherto we have given most of our attention to the microbe, its form, varieties, habits, etc., to the neglect of the condition of the soil necessary for its growth. Any system of hygiene, therefore, which aims at anything like scientific exactness, must consider the nature of the soil as well as the character of the micro-organism itself. This is of course under the supposition that there is a specific microbe for trachoma. But even if there should be no specific micro-organism there must be something which starts the morbid process into action. In trachoma it would seem that an inflammation of the conjunctiva coming from microbic infection, smoke, dust, vitiated air or other irritating influence is sufficient to prepare the ground for the specific affection. The first law, therefore, in the prevention of trachoma, or in the management of those suspected of having a predisposition to the disease, is the avoidance of those conditions which lead to conjunctival inflammation. These patients should be kept away from those suffering from any form of contagious ophthalmia. Most of all they should be removed from such overcrowding as produces a vitiated and irritating atmosphere, and they must not be allowed to follow any occupations where there is much dust or smoke. Out-of-door work is therefore

not always to be commended for it is precisely these occupations that furnish such conditions, particularly as regards dust. General farming is to be avoided, as a rule, for in planting and attending crops, harvesting, threshing, and in many other labors pertaining to farm work, there is commonly a great amount of dust and other irritating material floating in the air, while the ammoniacal vapors of the ordinary farm stable are very irritating to the conjunctiva. For the same reason dusty localities are to be avoided. The effect of climate on the development of trachoma is probably excited largely through these influences, for we find that as a rule those places on the sea-coast where there are not other actively productive causes in operation are affected in a much less degree than those interior localities which are subject to long droughts. Dryness and humidity of themselves do not seem of much importance. Some of the most malignant cases we have among the native-born Americans are found in the interior regions of Kentucky and West Virginia. Even the high altitude of Colorado is not free and most probably on account of the dust. Altitude itself, if we are to accept the testimony of many eminent observers, has a markedly good effect on the virulency of the disease, where there are no counteracting influences; but high altitudes are not to be commended if they are dusty.

In accordance with these facts, which it is earnestly hoped will be extended or modified by other observers, the ideal climate is one of an elevation where the air is clear and bracing, at least 300 meters above the sea level, and which is devoid of dust and other irritating material.

# MARKED IMPAIRMENT OF CENTRAL VISION FOLLOWING PROLONGED USE OF THE AFFECTED EYE.<sup>1</sup>

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**M**R. S., aged 30 years, a graduated student in the chemical department of the Johns Hopkins University, consulted me on February 16, 1897, on account of a pain and soreness which he had experienced for several days in and over his right eye. He stated that just after recovering from an attack of the grippe of a week's duration he had taxed this eye very severely, and explained that he had been engaged in "calibrating burettes." Three burettes had been assigned him for this purpose, and he had spent about five hours a day for six consecutive days in testing their accuracy, or in "calibrating" them, as it is termed, using his right eye only. The burettes are graduated to tenths by a cubic centimeter, but an error amounting to only a tenth of one of these tenths can be detected by a trained eye, and it is such almost infinitesimal departures from absolute accuracy that the student is expected to note and record. As each burette has a capacity of 50 cc. and each one of these cubic centimeters must be gauged in this careful manner, it can be readily understood that the strain upon the eye must be very considerable. Some students, it seems, calibrate binocularly, while others obtain better results by using only one eye.<sup>2</sup>

Mr. S.'s eyes had been slightly asthenopic for some time before the occasion which led him to seek my advice, but they had not annoyed him sufficiently to induce him to consult any one in regard to them. At his first visit the ophthalmoscope showed nothing abnormal except the presence of a slight

<sup>1</sup>Read before the American Ophthalmological Society, Washington, May 6, 1897.

<sup>2</sup>In calibrating the diffuse light from a window is used and falls upon the burette from one side, so that the gaze is not towards the light.



amount of hypermetropia, and there was nothing noteworthy in the external appearance of the eye.

A lotion of opium and boracic acid and a collyrium containing  $\frac{1}{8}$  gr. of sulphate of zinc and 12 grains of boracic acid to the ounce were prescribed, and he was directed to report in a few days if not relieved. The vision was not tested at this visit. Two days later he was seen and stated that the eye was not improving. The right eye then showed  $V. = \frac{20}{xxx} +$ ; the left eye  $= \frac{20}{xv} -$ . On February 20, two days after this, several small, well-defined, whitish exudation spots were detected in the right eye, in the neighborhood of the macula, such as are not infrequently observed in miliary choroido-retinitis due to accommodative strain.

February 24. A careful test of the refraction was made. Astigmatism was excluded, and  $+ .87$  s. glasses were prescribed, to be worn, probably, only in near vision. Vision in right eye about as when first tested,  $\frac{20}{xxx}$ .

February 27. Patient reports sight of right eye much dimmer. Right pupil is now somewhat larger than the left and is less responsive to light. Right eye,  $V. = \frac{20}{cc} (?)$ . Ophthalmoscopic changes not appreciably altered. Calomel to be taken every hour in  $\frac{1}{10}$ -gr. doses.

March 2. Right eye,  $V. = \frac{8}{cc}$ . Ophthalmoscope shows, in addition to the exudation in the macular region previously noted, slight inflammatory changes (exudative) in the retina near the outer and upper margin of the disc. Calomel discontinued and pilocarpine muriate prescribed, beginning with a dose (by the mouth) of one-sixth of a grain. Urine tested for albumen with negative result.

March 5. Vision unchanged. Field of vision taken, showing a paracentral scotoma for white as represented in the accompanying chart.

March 7. An improvement in the vision is noted ( $\frac{14}{cc}$ ), and from this time a progressive change for the better occurred.

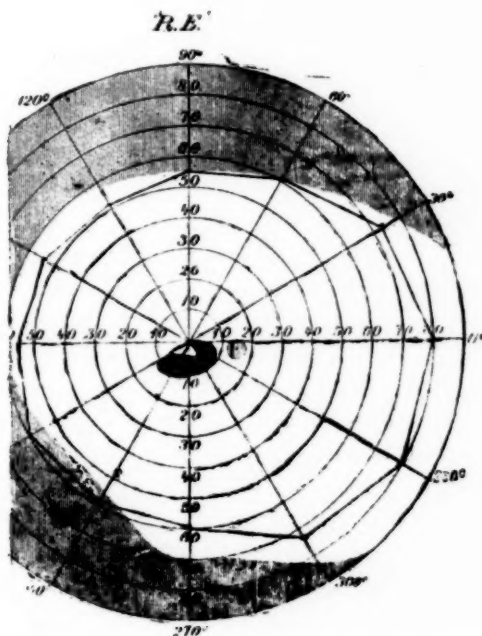
March 15.  $V. = \frac{20}{xxx} +$ . Pilocarpine discontinued and  $\frac{1}{24}$  gr. hydrarg. biniod. prescribed, to be taken three times a day.

March 29.  $V. = \frac{20}{xxx}$ ; scotoma has disappeared.

April 19.  $V. = \frac{20}{xx}$ , missing only one letter. Fundus examined without detecting anything abnormal.

May 3. Patient has been at work in the laboratory since

April 1, and has felt but little inconvenience from his eyes, though he says he is conscious of not seeing as clearly with the right eye as with the left. Is still taking the biniodide. A careful inspection of the macular region shows two minute whitish spots still present and slight irregular pigmentation. The retina near the disc presents a normal appearance. Right V. =  $\frac{20}{xx}$ , except one letter and three letters of  $\frac{20}{xv}$ . Left, V. =  $\frac{20}{xv}$ .



It would seem that the unusual strain to which the eye was subjected in this case produced a central exudative retinitis, not unlike that which has been observed as a consequence of prolonged exposure of the eyes to the direct rays of the sun or to the glare of the electric arc light. That the recently-recovered-from attack of grippe was a factor in bringing about this condition seems not unlikely. The points of interest are that the decided decline in vision should not have occurred until so long a time after the strain of the eye (eleven days after his first visit to me and about eighteen days after he had finished testing the burettes), and that with such seemingly insignificant ophthalmoscopic changes, the impairment of sight should have been so marked as it was ( $\frac{8}{cc}$ ).

ANTISEPTICS AND ANÆSTHETICS IN OCULAR OPERATIONS.<sup>1</sup>

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IN OPERATIONS upon the eye we have less to do with antiseptics than with asepsis. We do not have to disinfect a contaminated wound, but to make a wound that is clean and keep it from contamination. How to do this without causing irritation or hyperæmia of the eye is a factor bearing on the successful result of the operation which can not be overlooked.

All applications to the eye, before cataract extraction especially, whether they be antiseptics or anæsthetics, if they cause hyperæmia of the conjunctiva, they are antagonistic to the result desired, and should be avoided. Under this head come formaldehyde and eucaïne hydrochlorate. The former has no advantage over mercuric bichloride, since experience has shown the latter to be all that could be desired; and the best results are to be expected from that germicide which has the desired effect, with the least irritating influence.

The tendency to destroy the cutting edge of instruments, incident to bichloride solutions, may be overcome by refushing the conjunctival sac with a solution of acidum boricum just prior to the operation. Non-irritating antiseptics and non-irritating anæsthetics are essential requisites to success in ocular operations. The new local anæsthetic eucaïne hydrochlorate is a decided irritant. The anæsthesia of an eucaïnized eye is accompanied by an hyperæmia of the entire conjunctiva which outlasts the anæsthesia. Experiments have shown that it also causes a lachrymal hypersecretion.<sup>2</sup> These two factors alone debar it from ophthalmic practice. In corneal ulcers, foreign bodies, etc., the predominant symptoms are photophobia, lachrymation, congestion, and pain. The application of

<sup>1</sup>Delivered before the Medical Society of the State of Pennsylvania at Pittsburg, May 19, 1897.

<sup>2</sup>Berger.



this drug relieves the pain, but increases the conditions that produce it. The makers of the drug, when they recommend it in ophthalmic work, ask the ophthalmologist to ignore the fundamental basis of the science of medicine, and treat *effect* instead of *cause*. Its sole claims to ophthalmic work are its stability, and that it does not cause exfoliation of the corneal epithelium. The former ought not to be considered, as the expense incurred for a fresh solution of cocaine hydrochlorate is slight, and the latter advantage is not sufficient to cover the other objections. Hydrochlorate of cocaine is the ideal anæsthetic in ophthalmic practice, especially so for extraction. However, something depends on the method of its application. The frequent instillation into the eye at intervals of fifteen minutes, as advised in some text-books, is not only unnecessary, but a bad practice, and a detriment to the best final result of the operation. Anæsthetization of the entire eye should be avoided. Any drug that has a primary action, must have a secondary effect, and this is especially true of cocaine. The ischæmia produced is followed by a hyperæmia, the extent of which is in direct ratio to the profundity of the anæsthesia. Three drops of a 4 per cent. solution of cocaine hydrochlorate dropped in the line of section, is all the writer uses for an extraction with an iridectomy. In this way complete ischæmia of the eye is not only prevented, but also the increased afflux of blood to the eye, consequent on the dilatation of the vessels, which occurs after the anæsthetic effects of the cocaine disappear. A too profound anæsthesia from cocaine produces, after the eye is bandaged, the identical hyperæmic condition that should be avoided, and also increases the tendency to exfoliation of the corneal epithelium.

When cocaine is used sparingly, and the lids kept closed after its application, there is no exfoliation of the corneal epithelium. There is no increased afflux of blood to the parts, after the eye is bandaged, and there is no lachrymal hypersecretion.

KERATOCONUS.<sup>1</sup>


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 BY J. W. BULLARD, M.D., PAWNEE CITY, NEB.
 

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THE only excuse I have to offer for preparing this paper to read before the Association is, that in looking over the literature of the subject, I found it to be very meager, and especially so in the more recent works on ophthalmology at my command. It is much more exhaustively treated in works written a quarter of a century ago.

I hope to bring out a valuable discussion on the subject by men present who have had a large experience in the treatment of this disease, which we know is usually of more value to the members than is the subject matter of the paper itself.

In the reports of the Wills Eye and Ear Hospital of Philadelphia (kindly sent me by my friend and recent house surgeon, Dr. J. Floyd Murdoch, of Pittsburg, Pa.), for the years 1894 and 1895, out of a total of 12,614 cases of eye disease treated during the former year, there were 1,486 cases with disease of the cornea and sclera, of which number 22 cases were cornea conica. In the latter year the total number of cases was 13,856; 1,739 cases of diseases of the cornea and sclera, only 18 of which being the disease in question, or a total of 40 cases in 26,470 cases of eye disease treated during this period of two years.

In the report for the year 1895 of the Royal London Ophthalmic Hospital, Moorfields, which I received through the courtesy of Messrs. Edward Nettleship and E. Treacher Collins, who are members of the staff of that institution, I find that out of a total of 28,474 out- and in-patients treated during the year, there were 12 cases of conical cornea operated on. How many cases presented themselves who were not subjected to operation, the report does not state.

From the above reports it will be seen that conical cornea is a comparatively rare disease.

Keratoconus is a non-inflammatory disease in which the cen-

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<sup>1</sup> Read at the Second Annual Meeting of the Western Ophthalmological, Otological, Laryngological and Rhinological Association, held in St. Louis, April 8-9, 1897.

tral part of the cornea, gradually and without any apparent cause, begins to bulge forward in the form of a cone. The apex of the cone is rarely central, usually below the center and in my experience external.

In the early stages the cone is perfectly transparent and the peripheral portion retains its normal curve, subsequently, however, the central portion continuing to increase its bulging, the peripheral parts are more or less involved in the general conicity. At first the patient complains, if he has previously worn glasses, that his lenses do not give as clear vision as formerly, or if he has not been wearing correcting glasses, that his vision is becoming dim. At this early period we must examine very carefully or we will overlook the true cause of the defective sight. We note a diminution in the size of the corneal reflex in the central part of the cornea. When we reflect the light from the sky or ophthalmoscope on the cornea we get a bright central reflex from the fundus, surrounded by a dark or shady zone which in turn is surrounded by a bright zone of fundus reflex through the peripheral, or normally curved cornea. The shadow plays around, but never crosses the central fundus reflex. As the disease becomes more advanced numerous phenomena appear as the reflected light from the mirror is made to play on the cone from different points. The retinal vessels appear much distorted when viewed with the ophthalmoscope, ever changing in apparent shape and size, with every movement of the observers head.

As pointed out by Dr. Knapp, the bright central zone is due to the reflection of the fundus through the central part of the cone, and the outer bright zone to the fundus reflex through the normally curved periphery of the cornea and the dark intermediate zone to the diffusion and complete reflection of the rays of light at the base of the cone where it passes over into the normal curvature of the cornea.

The great confusion of vision is caused, not so much by the conical condition of the cornea, as by the irregular, astigmatic condition which leads to great distortion of images. As the disease becomes more pronounced it is quite easily recognized, especially when viewed laterally, the cone is easily seen, and when quite pronounced shows readily through the closed lids, as the ball is moved in different directions.

When the disease is far advanced, from thinning of the

cornea, increased friction and exposure, the epithelium at the apex begins to be disturbed, the cells are swollen and exfoliate, an interstitial keratitis manifests itself, spreading several millimeters in each direction from the apex and causing a dense opacity. The eye now becomes painful, the episcleral vessels engorged, photophobia supervenes, and there is great increase of lachrymation. Oblique illumination and a magnifying lens will show the delicate cornea propria denuded of its epithelium. What is quite remarkable, though the keratitis at the apex may become severe, perforation rarely takes place.

The patient, as the disease progresses, seems to become more myopic, and brings the objects looked at very close to his eyes, but perfectly clear vision is not attainable with spherical, concave lenses, because the bulging of the cornea is not spherical but conical (hyperbolic). (Fuchs).

As a rule both eyes are affected, usually one in advance of the other.

It usually makes its appearance during the second or third decade of life and is said to be more likely to attack females than males. It may date its onset from some exhausting sickness. It is often associated with chronic dyspepsia and appears to be due to defective nutrition in that part of the cornea farthest from the blood supply. (Nettleship).

Its development is very graduated, ultimately, however, the process comes to a standstill, but, as a rule, not until useful vision is nearly or quite lost. The bulging occurs because the front of the cornea progressively becomes thinner, and gradually yields before the intra-ocular pressure, which, however, is not increased, but rather lessened considerably below the normal. This is probably the reason that perforation so rarely takes place, the power of resistance and intra-ocular tension being proportionately equalized.

The real cause of conical cornea is represented by the unknown quantity X, whose true value has never yet been found.

The prognosis is not very favorable as unaided by treatment useful vision is usually lost. In recent years the progress has been stayed, and vision very much improved by operation and properly adjusted lenses.

**TREATMENT.**—All cases of myopia should be very carefully examined by retinoscopy for the first evidence of conical

cornea, and if discovered, everything which tends to increase the trouble should be avoided. The patient should be much in the open air, avoid using the eyes for near work, nutrition should be stimulated as much as possible by tonics, good food and proper hygienic environments. The best possible correction should be given with lenses, dry pressure bandages applied to the eyes at night, and a course of myotic treatment with eserine or pilocarpin be instituted, the results of the latter being carefully watched. These things are done with a view of checking the progress of the disease

Many modes of operative procedure have been advocated, first, to limit the disease; second, to correct the deformity of the cornea; and third, to establish an artificial pupil. Sir W. Adams removed the lens to neutralize the myopia. Mr. Wardrop recommended frequent tapings. Iridectomy and iridodesis were done, both to check the progress of the disease and to afford a new pupil. Von Graefe produced ulceration of the apex; Bowman and De Wecker employed trephines; Mr. Bader excised an elliptical piece of the apex, and Mr. Critchett, as it was difficult to get both sides of the wound of equal size, invented a double knife, so arranged that when shoved through the apex it cut out an equal piece from each side.

Perforation through the apex with the galvano-cautery is a classic treatment now. The central idea to meet the second indication is to get a flat cicatrix at the apex of the cone which very favorably influences the conicity. As opacity, to a greater or less extent, follows this operation, an iridectomy is frequently required to form an artificial pupil behind transparent corneal tissue.

I recently operated on a severe case of conical cornea in a single lady, 26 years old, who had been mildly insane for the past six years. She was a well developed woman in robust health except in her mental faculties. About the time her mind became affected her eye-sight began to fail. Shortly afterward, in June, 1891, she was brought to me with the statement that she had always been near-sighted, but was much worse since the derangement of her mind. At this time vision was as follows: O. D. =  $\frac{2}{cc}$ ; O. S. =  $\frac{12}{cc}$ . With the following correction vision was  $\frac{20}{LXX}$  in each eye; O. D. — 5. D. s.  $\bigcirc$  — 2.50 D. cyl. ax.  $150^{\circ}$ ; O. S. — 6. D. s. This correction was given her and worn for about four years with apparent satis-



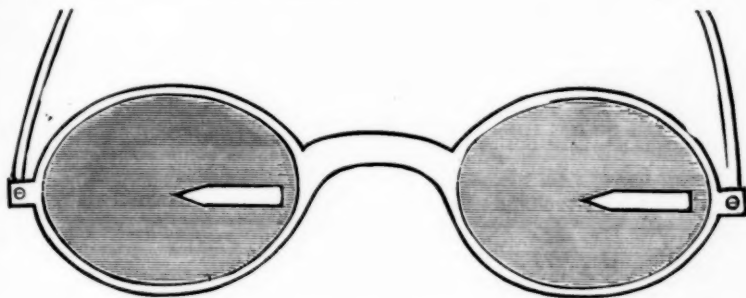
faction. She then broke one of the lenses and as her mind was not right, she was allowed to go for a year without attention, during which time she read more or less, bringing her paper or book very near to her eyes.

In January, 1896, as she was going to make her home with an uncle in another State, she was brought to me again with well advanced keratoconus of both eyes, but more marked in left. V., O. D. =  $\frac{2}{cc}$ , same as before; O. S. =  $\frac{1}{cc}$ . As she was going away I had not time to treat the case, so prescribed — 20. D. s. light-blue tinted lenses which improved her vision somewhat and wrote the family physician to refer her to some neighboring oculist. The oculist to whom she was taken told her relatives that nothing could be done and she would soon be blind.

She returned in December, 1896, with the apex of the cone of the left eye opaque and considerable irritation about the eye. After the instillation of atropia the blade of a Graefe cataract knife was passed vertically through the apex opening the anterior chamber and a pressure bandage applied. One week later the knife was passed horizontally in the same manner, the upper margin of the wound grasped with an iris forceps, a small piece removed with iris scissors and bandage re-applied. The bandage was removed once each day and the conjunctival sac flushed with a boric acid solution. One week later the incision was repeated and a piece clipped from the lower wound margin. The patient had, when last seen, nearly a normally curved cornea with a small opacity which will probably necessitate an iridectomy after the cicatrix has accomplished its full force when the proper refractive correction will also be given. Both eyes were kept under the influence of a one grain to the ounce solution of eserine after the last operation. It is always advisable to use atropia before opening the anterior chamber for fear of anterior synechia. In the way of lens correction no rule applies. The eye is irregularly astigmatic, and frequently changes in a short time. Unless there is opacity the patient usually sees best while under the influence of a myotic, for most of the distorted rays are shut off by the contraction of the pupil. Simple cylinders of high refractive power may be of much utility in some cases.

A stenopæic slit set at the proper axis for the particular case may give fairly useful vision. In a recent letter from Prof.

H. Snellen, of Utrecht, to the writer, he gave his latest suggestions for the treatment of conical cornea, and kindly drew for me a representation of his spectacles, which I here reproduce, together with a copy of that part of his correspondence bearing on the subject as follows:



"H. Snellen's spectacles for cornea conica, consisting in black metallic plates with stenopæic slit, running from left to right, and ending in the middle with a sharp point. Enables the patient to read if the point of the slit is brought just in the visual line. I further apply dry bandage at night, alternatively on left and right eye, and in progressive cases I do a series of small sclerotomies f. i., twice a week, all round the corneal edge, each time one. \* \* \* Yours faithfully,

PROF. H. SNELLEN."

#### DISCUSSION.

DR. TIFFANY.—In regard to the etiology of keratoconus I believe it is pretty well known that it is due almost always to interstitial keratitis. There is a tissue degeneration, the cornea loses its tone and from intra-ocular pressure the conical cornea results. The Doctor speaks of never having seen it follow ulceration of the cornea. This is somewhat remarkable, when we remember we never have ulceration with interstitial keratitis. You will find that a very large per cent. of conical cornea is due to interstitial keratitis. As to the treatment, the Doctor has outlined that. The refraction in these cases is not a true myopia, it is irregular astigmatism, sometimes it can be benefited by cylindrical glasses or by spherical concave glasses, but it can not be very much helped as a rule. The operation which is the best produces a flat surface. This may be improved upon by an iridectomy.

DR. BULSON.—I am somewhat surprised to hear that conical cornea is caused by interstitial keratitis. My experience has been exceedingly limited with this class of cases; I have seen only two, one about six years ago and the other last fall, but I must confess that I never saw keratoconus develop from interstitial keratitis. It would also seem strange to me that it should occur in such a small area and that in the center of the cornea. Examining a conical cornea closely it looks as if a bubble of water was located on the anterior portion and I can not understand why there should not be more of the typical appearance of interstitial keratitis if that is the cause of it, though theoretically it would seem that it might cause this trouble. The first case I observed I did absolutely nothing for. I found no means of giving any particular improvement. I tried some six or eight times and spent considerable time in attempting to give some sort of correction, but I found no lens that would do it. I informed the patient that I knew of nothing that would give a positive relief. A year ago I heard from the patient, that the process seemed to have stopped.

The case I saw last occurred in a lady, 18 or 19 years of age. She said she had noticed her vision failing about a year previously. Upon examination I found a typical conical cornea a bubble-like appearance on the upper portion. There was no evidence of interstitial keratitis. She was a healthy, robust girl. No lens gave any improvement. As in the other case, I did not offer to do anything for this reason,—that I could not understand why these cases should be benefited by producing an opacity of the center of the cornea with a vision already reduced. It is possible that an improvement does occur. I have no doubt it does, because some of the cases reported tend to show that, but these cases, so far as I know or have been able to discover from the literature on the subject, go just about so far and there they stop. The patients generally see fairly well for ordinary purposes, in fact, my patients could apparently read with comfort, the main difficulty being to see at a distance as vision was reduced in one instance to  $\frac{5}{cc}$ .

DR. TIFFANY.—In regard to the explanation I gave I will say that it is from my own experience. I have had hundreds of cases of interstitial keratitis, and almost invariably they will result in conicity of the cornea. I have about 1300 (?) a year, and a great many of these cases have conical cornea.

DR. BULSON.—It certainly is possible to have keratoconus without preceding interstitial keratitis.

DR. TIFFANY.—If you do, it will probably be congenital. It may follow ulceration of the cornea and the giving way of some of the lamellæ from intra-ocular pressure; but probably it would be congenital, when it is not due to interstitial keratitis.

DR. ALT.—I must confess that I also was astonished at the statement that keratoconus was almost invariably the result of interstitial keratitis. I do not doubt the possibility of the cornea becoming stretched in consequence of the parenchymatous keratitis, but it so happens that the few cases which I recall as having come under my observation, had not the slightest symptom or history of anything of that kind. I recall one young man who, under my observation, developed an astigmatism and the keratoscopic picture reminded me forcibly of keratoconus. I told the young man I was afraid his cornea would develop keratoconus and asked him to let me see him from time to time, and he has developed a typical keratoconus in a few years in one eye. He never had any symptom of interstitial keratitis. Another case I recall was that of an elderly lady who consulted probably all of the oculists of this city. She had an enormous keratoconus in both eyes with absolute transparency. I have proposed an operation to her, but she will not consent. With regard to the therapeutics, the operations may be of some help, but a very good result I think nobody has reached. With regard to the etiology, I have had occasion to examine three cases histologically. In two I found nothing to explain the clinical condition. In one eye there was scar tissue and a rupture of Bowman's membrane at the apex of the cone.

DR. BULLARD.—In answer to Dr. Tiffany's statement that keratoconus is the result of interstitial keratitis, so far as the cases I have seen are concerned, there was absolutely no interstitial keratitis when I first saw them; but as the cases progressed, by the aid of focal illumination and a magnifying lens, one could see the fine striate lines of beginning interstitial keratitis. This did not appear, however, till the cornea at the apex of the cone was much thinned and from exposure and increased friction the protecting epithelium had been destroyed, and the cornea proper exposed. Until the disease is well ad-

vanced the cornea is perfectly transparent and looks as Dr. Bulson expresses it, like a clear bubble on the anterior portion of the cornea.

A year or two ago a physician of Youngstown, Ohio, whose name I do not now recall, read a paper on this subject before the Section on Ophthalmology of the American Medical Association, in which he reported two cases treated by the cautery with quite flattering results. This paper was discussed by Drs. Knapp and Noyes, of New York, Chisolm, of Baltimore, and Jackson, of Philadelphia.

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## THE TECHNIQUE OF CATARACT EXTRACTION.<sup>1</sup>

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BY B. E. FRYER, M.D., KANSAS CITY, MO.

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THE principles governing general surgical procedures are of course in the main applicable in ophthalmic surgery; yet in the latter, when cutting operations upon the eyeball are done, we have conditions which obtain in no other portions of the body. Here we have a practically spherical, ever moving, body—not solid—but filled with two totally different liquids, one of which latter is, if lost, readily and quickly replaced without injury, and for the other, a portion of it escaping, is not restored and the damage resulting is more or less permanent. Separating these liquids from each other at the lens periphery exists but a frail and exceedingly thin membrane.

We have in addition in and around and attached to this movable organ certain muscles which, under ordinary conditions, are subject to voluntary control; yet these muscles—the six oculars proper and to which should be added the orbicularis—when an eye is opened in any operation, can and do get beyond the voluntary control of the patient and by their contractions have the power of instantaneously of not only impeding the operation, but also of destroying the usefulness of the eye.

The effects of these muscles are of course fully understood

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<sup>1</sup> Read at the Second Annual Meeting of the Western Ophthalmological, Otological, Laryngological and Rhinological Association, held in St. Louis, April 8-9, 1897.



by oculists, yet their power for harmful contraction when an eye is opened, is often overlooked by ophthalmologists even, and not considered at all by generalists. For instance, take the four recti, the application of their force when under tension is from before backwards, and the resistance being given by the pad of fat posteriorly, compression of the whole globe occurs, and the incompressible fluids of the eye can escape. We may and can and do keep many patients quiescent during and after an eye operation, but a certain proportion are more successful in movement than the Keely motor. The amount of ocular—muscular action in operative eye work can neither be foreseen nor prevented—we can only attempt to minimize its effect. All of this has bearing upon the operation for cataract extraction—the kind of operation and the methods of doing it.

The history and a description of the operation, and the size, shape and location of incision would fill a moderate sized volume. The incision now made by the most successful operators is wholly within the corneal limbus and includes nearly half the cornea. A large number of operators do what is called the simple operation which does not include an iridectomy. This, it must be admitted, gives, when the operation is successful, an ideal result; but there is always the risk, after the operative work is done, of a prolapse of the iris occurring, and if this does not occur at this time it may occur at any time during twenty-four or forty-eight hours afterwards. A few excellent operators do not apply dressings to the eye for half an hour after the operation, putting the eye under a probationary observance, and if a prolapse then takes place, endeavor to reduce it, and if this latter is unfavorable, follow with an iridectomy then. Some few remove the prolapsed iris later if the prolapse occurs after the toilet is made and as late as two or three days after it. Others allow the later prolapse to take care of itself and this latter leaves a more or less crippled eye.

Now it seems that this is bad surgery. It is hard to find a simile in general surgery for there is no other organ of the body like the eye either in delicacy or intricacy of its anatomy; but what would be thought of a laparotomist if he gave a chance for omentum or an important viscus to prolapse through his wound after dressings were applied, and if he did not provide against such a mishap. I insist, a so-called simple ex-

traction—that is, one without an iridectomy, is not rational for the reason given viz., the possibility and probability of iritic prolapse, and even if that does not occur, the iritis which may result and which does in many instances result from the unavoidable bruising of the iris during the delivery of the lens through the pupil which may spoil the final effect.

I insist, moreover, than an iridectomy should be done and that it should be done as a preliminary operation at least four weeks prior to the extraction. We gain by this method the removal of the risk of iritic prolapse and its consequences and we are enabled to materially shorten the time required for the extraction ordinarily, and lessen the risk of vitreous loss. We lessen the bruising to the lips of the incision, lessen the amount of irritation which the operation produces, and we improve all the conditions for immediate closure and healing of the wound. By the simple extraction method we can not completely remove cortex, or at least we do it with difficulty and only by prolonging the operation.

An iridectomy, if done at the time of extraction, increases dangers and risks; whereas, if done four or six weeks prior to the lens removal, the risk of iritic inflammation is minimized or done away with.

The average time required in my extractions is rarely over thirty seconds, and the preliminary iridectomy but a few seconds longer. I found, with the proper antiseptic preparation of my cases, that there is absolute freedom from reaction, and that immediate closure and healing of the wound takes place.

With reference to these antiseptic preparations I would say that the conjunctival sac of the eye to be operated is flushed daily with a 1 to 6000 sublimate solution and dressed with sublimate gauze until all sign of yellow secretion disappears—that is, is no longer found at the canthi on changing the preparatory dressings.

I would make the following points: That while the simple extraction, when successful, gives an ideal result, it too frequently is followed by iris prolapse, which cripples the eye more or less permanently.

That by a preliminary iridectomy we make iritic prolapse almost impossible, and if the portion of the iris excised is

small, the visual result is practically as good as that following simple extraction.

That complete removal of cortex is rendered possible by the previous iridectomy, and that the extraction is more readily and safely done, and that bruising the iris and lips of the incision are minimized and the possibilities of immediate healing maximized.

That in view of the fact that we have by the simple operation from 10 to 25 per cent. of unavoidable prolapse of iris, we have no right to take the chances of giving a crippled eye by doing that operation.

#### DISCUSSION.

DR. STILLSON.—I wish to heartily indorse this paper. I think of the last one hundred cases of extraction which I reported to our State Society one third were simple extractions. For many years I had made the iridectomy at the time of the operation, and then I began to make a simple extraction, as it is made by Dr. Knapp, of New York. At first I thought that the results were all that could be desired. But the unfortunate thing about this is the prolapsus of the iris that will occur in the very cases in which you do not expect it. One should think that with a neater technique, with better surroundings of the patient, more careful study of the cases we would not have prolapsus, but you may have prolapsus even in a case where you have made your incision perfectly and have delivered the lens easily. To find a prolapsus after such an ideal operation is enough to disgust anybody. And you will find that the longer you leave the prolapsus the more difficulty you will have with it. I have had such prolapsus occur without any apparent cause, and I have allowed it to go on, and by and by it increased so that I was forced to remove it. I did this in a case some four weeks afterwards, put in three sutures, taking them superficially so as not to wound the ciliary body, but to my astonishment the bulging occurred again, and then I had a badly disfigured eye, although there were no bad results to the inner structures of the eye. Now I am up to the my thirtieth case on the second hundred since I abandoned the simple extraction, and in these cases I have made a preliminary iridectomy and all those cases, fortunately, have turned out

well. I have made the second operation—that is, the extraction—as soon as five days after the preliminary iridectomy. I notice this,—the patient will not remain in bed more than a day or two after an iridectomy, and when it is properly made, that is sufficient, in fact we do not in most cases require to put them to bed at all; after the extraction, also, the patient is not kept confined as long as formerly. The second wound I make well in the cornea. The iridectomy wound is made well back so that the line of the second incision lies anterior to it. The cases in which I have resorted to the preliminary iridectomy have all resulted well. Moreover, if the lens is not entirely ripe, my experience is, that after the iridectomy the lens will rapidly ripen. The iridectomy is an operation which is generally attended with but little reaction unless you have hæmorrhage or some other complication and it is a perfectly safe operation, it can be done with little pain to the patient and does not confine him to bed. You will find that with the two operations the period of confinement of the patient will not be as long as it is under one operation without preliminary iridectomy. I wish to say, too, that I have absolutely abandoned the roller bandage. My toilet consists in washing out the eye before the operation with a  $\frac{1}{8}$  per cent. boracic acid solution and the same after the operation. I also wash out the anterior chamber. Then I use enough cocaine after the operation to get the eye perfectly quiet and generally put in a little atropine to control the pupil. Then I put on a piece of gold beater's skin, leaving the internal and external canthus free. Then I cover the eye with a mask. I direct the interne or nurse, in case pain comes on after a few hours, to remove the hood and drop a few drops of cocaine solution into the corner of the eye. This will usually quiet the pain. My patients usually go to sleep after a cataract operation and sleep till the next morning. The per cent. of cases where you have iritis from cataract extraction, if you have made a preliminary iridectomy, is almost *nil*, whereas it used to be the rule to expect iritis after simple extraction.

DR. WHEELLOCK.—It is a matter of great pleasure to me to me to hear Dr. Stillson speak as he does about simple extraction. Nearly a year ago I heard him dilate on the beauties of simple extraction and I said then that I hoped I would live to hear him come back to sensible surgery. I do not believe in

preliminary iridectomy, such as Dr. Fryer has set forth here, except in cases of abnormal conditions about the eye, where we have reason to suspect there are deep-seated troubles; there the preliminary iridectomy is permissible to get rid of the irritation. But the objection to preliminary iridectomy is this,—that it makes two operations where one operation is sufficient, and where you have a nervous and irritable patient the dread of the second operation is a great deal more than the dread of the first one, and if you do not have an accident with the first operation, you are very apt to have one with the second. Besides, these patients are old and they do not like confinement, and the less they have of it the better. The very best reports I have seen in simple extraction involved ten per cent of prolapsus of the iris and I say that we provincial operators, we who are away from the metropolitan centers, have no business to trifle with our patients. It is very easy and nice for a metropolitan operator who operates on hundreds of cases a year to do these simple extractions and a few failures cut no figure; but I can not afford to do it; I have to preserve my reputation. A patient does not come for a cosmetic effect; he comes to get his sight back and it is my duty to stand in the relation of protector to that patient and not to try to produce a cosmetic effect unless I can accomplish both at the same time. I know absolutely that by doing a peripheral extraction I can in 95 per cent of the cases give the patient a good result; therefore it is my duty to give the patient a good result and not jeopardize his eyesight by an operation which will look simply to the cosmetic effect. Then as to the bandage. The very same principle obtains about the question of bandaging the patient's eye. It is a question of preserving the patient's sight and each one of you know from your experience that by the seventh, eighth or ninth day you are liable to have a serious result due to some injury by the patient striking his eye in his sleep; therefore, it is our duty to protect that eye, and in order to do that I think we should use the roller bandage, with a good body of cotton beneath it. I do not believe in the gold-beater's skin or court plaster, that simply serves to hold the eyelids.

DR. STILLSON.—The very reason the speaker gives for making one operation is the reason I assign for making two. He says these patients are restless, they are apt to be fright-



ened and easily alarmed. That is all true. But my experience has been that when I subject a patient to a preliminary iridectomy which does not give him much pain, he will be much better prepared for the extraction, and in my experience they behave better after the preliminary iridectomy because they see that there is very little pain. I can tell them that the second operation will hurt no worse than the first, possibly not so much, and they are perfectly willing to submit. Now as to the roller bandage; the very reason he assigns in favor of the roller bandage I assign for not using it. You do not want the patient to disturb the eye; the patient will disturb the bandage. If it is a little tight, if it does not fit well, or is too long, or if the head gets warm, or the eye begins to swell, or a few tears come, the patient will invariably get his hands up and disturb the bandage; a simple movement even of the head on the pillow will often disturb the bandage. I fix the eye so the tears can drain out, so that there will be no pressure, and in this way I avoid all danger of the patient disturbing the part. Not only that, but if there is a little pain which usually comes from the scratching of the edges of the wound against the center surface of the lid, the nurse can lift up the hood and drop in a drop of cocaine solution and stop it. So I say that the gold-beater's skin is amply adequate; the eyelid is the best splint that can be used. In the second place the less weight we have the better. All we want is rest and quiet. The hood allows the patient plenty of ventilation in and around the orbit, the tears will roll out and fall down the cheek and there is no pressure by secretions about the eye. So the Doctor's arguments against are the very ones that I use in favor of my procedures. I will say that I am done with the simple extraction. I prefer the preliminary iridectomy.

DR. REYNOLDS.—I am very sorry that I cannot adopt one fixed rule in my practice. But it is a fact, that I have frequently commenced treating a case with the intention of making a simple extraction and have ended by supplementing it with an iridectomy, and I have just as frequently started with the intention of doing a preliminary iridectomy and changed my mind when I got my fingers on the eye. I take it for granted we all see cases where we are satisfied that a preliminary iridectomy is desirable. I have seen preliminary iridectomy done just within the scleral margin followed by nothing

peculiar and the subsequent extraction, the section being made within the limbus of the cornea without any accident, followed by bulging of cicatricial tissue. The cicatrix in such cases undergoes atrophic changes and it becomes weaker. As it does after operations for the radical cure of hernia so it happens with these two wounds in the wall of the globe, the cicatrization of them is not a permanent final condition. That does not always happen, but sometimes. As to the manner of dressing, I would like to say that I have not used the bandage for more than twenty years. I am afraid of it because if the patient happens to put his hand to his face and relax the bandage he is apt to cause trouble; the pulling on the bandage by moving his head is apt to disarrange the parts and disturb the union of the wound. In reference to prolapsus of the iris I believe if we could only eliminate the element of pressure in the dressing and restrain the patient in his movements of the eye, we could reduce the frequency of prolapsus. I lay a little film of cotton well about the lash and then I take strips of rubber plaster a quarter of an inch wide cut short, just running from the brow fairly upon the zygomatic arch and lay them at short intervals, using three or four strips, and taking great pains to leave the inner and outer canthus free and exposed to view. But I prepare my patient differently, I flush the eye not with a one grain to the ounce solution, but with a ten grain to the ounce solution of boracic acid before operating, and the reason I do it before operating is because my cocaine will not produce anæsthesia if I use the bichloride of mercury first. After that I flush the eye with bichloride of mercury solution, one-sixteenth of a grain of bichloride of mercury and ten grains of chloride of sodium to the ounce of distilled water. This solution I use in washing the part after operation. After I am done flushing, five, ten or fifteen minutes after the operation is completed and I see no floating shreds of cortical substance, and there is no imprisoned portion of iris or capsule lying in the lips of the wound, and the pupil has contracted normally, then I instill a solution of eserine, one grain to the ounce of water, and to keep it from putrefaction I add one-quarter of a grain of carbolic acid, which also diminishes the irritation which the eserine sometimes provokes. With this sort of treatment I am able to secure perfectly satisfactory aseptic conditions. The plaster places my patient's eye in a good position and

keeps it so permanently. Of course there are difficulties which arise and which will remind us that we have no absolutely ideal method of procedure, but to my mind this is the safest.

DR. REYLING.—I have made thirty cataract operations, two of them with a preliminary iridectomy. In the twenty-eight cases in which the simple operation was done I had five prolapsus. The first one happened about five hours after the operation. The woman had a good deal of pain and I found the iris was prolapsed. I tried to replace it and more iris came out, so I removed it. Of the four remaining cases one prolapsed about the third day, one the second week, and the other a week after. In one of the cases I tried instead of replacing it to allow it to go on without doing anything and inflammation set in so that I had to remove it. The wound was not healed and I enlarged the opening and removed the prolapse and some little shreds that were entangled in the wound. After that I washed out the wound with an antiseptic solution and applied a bandage. At that time I used bandages. The two last operations I made with preliminary iridectomy. About preparing the eye for an operation for the removal of cataract or any other operation, I always, if the eye is healthy and there is no conjunctivitis, thoroughly wash the eyes with bichloride 1:5000, and not only wash them but I turn out the lids and thoroughly flush them. If there is conjunctivitis I never operate until that is cured. I have stopped the use of the bandage and I have had better results since. In place of using gold-beater's skin or cotton I use a plan of Dr. Knapp's, he just lays a piece of corrosive sublimate gauze on the eye and then places a few strips of adhesive plaster across. My practice is small, but in the Manhattan Hospital we had from ten to fifteen cases every week and there the simple extraction is made and with pretty good results; very seldom there is a prolapsus of the iris. We had one surgeon who was not very careful about antisepsis and he was the only one who, as a rule, had bad results, but all the rest used antiseptics and hardly ever had suppuration after an operation.

DR. TIFFANY.—I certainly do not agree with Dr. Fryer in all he said as to the technique of the operation for senile cataract. I disagree with him in the size of the section, in that it should not embrace more than is absolutely necessary (the Doctor speaks of one-half the cornea); if the incision is small

we are more apt to have union by first intention. As to waiting for half an hour after the operation to see whether you will have a prolapsus or incarceration of the iris, that would be unscientific. However, I believe that it has been suggested by a very prominent oculist, a member of the American Medical Association. In fact, he speaks of leaving the eye unbandaged. Now as to the simple operation or that with iridectomy. I am something like the Frenchman, I respect the iris and I never cut the iris unless I am obliged to; it is only in complicated cases that I would make an iridectomy and certainly I never would make a preliminary iridectomy unless it would be in cases of complication where there was iritis and where the cataract was not fully developed. Then I would make it. While I was in Paris the last time I spent several weeks, in fact months, with Dr. Panas who, perhaps, makes the operation oftener than any man living, as he is at the head of the largest institution in the world, and I have watched him operate month after month and never saw him make anything but the simple operation; I have watched his results and they have been most excellent. I have never seen an incarcerated iris nor prolapsus and in all the cases the pupil was central. Dr. Panas always washed the anterior chamber with boracic acid solution, I neglected to say. In Hansen's clinic at Copenhagen they said they would not dare to throw any solution into the anterior chamber; they would be afraid to do it on account of the pressure, which might produce iritis. In regard to a coloboma being as good as a circular pupil, certainly such a statement we can readily see can not be true. If it was true then surely Nature would give us elongated pupils instead of circular ones. As we all know the lens does not reflect light equally in all its parts; it is only the central portion of the lens where the rays of light come to a focus properly. So that the circular pupil must be the better. There is no pain really in the extraction of the cataract unless you make iridectomy. You can not anæsthetize the iris completely with cocaine as ordinarily used and therefore there is some pain. I used to make iridectomy, but never make it now unless obliged to. I always replace the iris with a curette, smoothing it back into the anterior chamber and seeing that it is not incarcerated, especially at the angles of the wound, see that the lips of the wound are in perfect apposition and that there is nothing there



to prevent the healing by first intention. The old practice was to close the eye and not open it for several days afterwards. You were allowed to wash the margin of the lids and keep them clean, but that was all. I always open the lids the next day; I open them every day and watch the eye and see how it is getting on and put in eserine every day when necessary, seeing to it that the pupil is contracted and that there is no prolapsus or incarceration. In dressing I am careful to flush the conjunctival sac with the bichloride solution. I do not use the roller bandage; never used that. All the pressure we want there is the normal pressure of the lids; that is brought about by the dressing that is used by Dr. Knapp,—the bichloride gacze. I strap this on with ordinary adhesive strips, one strip across the brow, another across the cheek, taking care that there is no pressure upon the eye. Iridectomy may make the operation safer, and I suppose it is safer if your hand is not entirely under your control. If you do not make the operation very often make a preliminary iridectomy or an iridectomy at the time you extract; but if you have had an extensive experience, if you have your hand thoroughly under your control and particularly if you are ambidexter, I think the simple operation is just as safe and it certainly brings about better conditions and appearance of the eye.

DR. KEGLEY.—I just wanted to say that my experience was that there is greater difficulty with the simple operation as the iris retains so much of the cortical substance. I would like to know the manner in which others get that out of the way. It comes out very easily if iridectomy is performed. I have had great difficulty in removing it just when I wanted to.

DR. BARCK.—I am sorry that I did not hear the paper read by Dr. Fryer. I would only like to make one remark in regard to the statement by Dr. Tiffany that Dr. Panas has had no prolapsus. I do not know anything about his statistics, but if he has had no prolapsus at all it is absolutely marvelous, as to my knowledge there is no other operator living who has not from time to time had secondary prolapsus. The average is from 4 to 6 per cent., and I think in the statistics mentioned by Dr. Knapp even 9 or 10 per cent.

DR. TIFFANY.—I did not say that he had no prolapsus, but that during the time I was attending his clinic for several months no case of prolapsus came to my knowledge.



DR. FRYER.—I would like to reply to the gentlemen in the order in which the discussion took place. One of the gentlemen spoke of the confinement of the patient after the operation. This is really unnecessary after a preliminary iridectomy. I do most of my preliminary iridectomies in my office. There is little necessity for confinement after an operation which takes only twenty or thirty seconds, the time in which the extraction is made. The patient need not go to bed at all. I prepare my cases for operation, using for several days, sometimes for two or three weeks, an antiseptic dressing. The rationale of this has been shown by Dr. Welch, of the Johns Hopkins University of Baltimore, who found that where the surgeon makes the surface aseptic that he does not really interfere with the life of the microbe. After thorough cleansing of the surface with a sublimate solution if you scrape off the epithelial cells and put them into the culture tube you get no growth, but if you precipitate the sublimate with the bisulphide of ammonium and then expose the epithelium in the culture tube you get a growth. This shows that the sublimate has simply for the time being rendered these microbes inert. I believe the same thing takes place in the conjunctival epithelium and if you apply a solution several days before the operation the microbes in the epithelial cells are quiescent, and do no harm. Several gentlemen spoke of boracic acid. The bacteriologists tell us that boracic acid is no antiseptic and if you rely upon boracic acid as I understand you are doing, you have a very slender support; it is practically not a germicide and you can not make it strong enough to make it so. In regard to making two operations, a preliminary iridectomy and the extraction, Dr. Stillson said that, in place of being difficult this is an advantage, that you get a knowledge of your patient's character, and you know how he will behave. This is true. In regard to not making the iris anæsthetic, you can do it, and most of the gentlemen who remember Koller's first statement will remember this. I talked with Dr. Koller about it and he states that you can make the iris free from pain as you can the cornea by using a solution three or four times, making it weak so it will not interfere with the integrity of the cornea and making the applications far enough apart. About the prolapsus in simple extraction, the best that I could get from the statistics that have been given, from the very best

operators, is 25 per cent. And I do not see how you can reduce it very much; but if it is only 10 per cent. or 6 per cent. as Dr. Barck states, that is a very serious factor. I have seen a number of the results of the operations of the very best operators living—I do not care who they are, there are none better than whom I quote—and I know that they give twenty-five per cent. as the percentage of prolapsus of the iris after the simple operation of extraction. Dr. Reynolds stated that he had no rule in making an operation. Well, as to going by a general rule, when you get to the operation, you can not do it—you can not make a general rule—except to avoid risks as far as possible; but I believe the time will come when the practice of making the simple extraction will be largely abandoned. In regard to cicatricial tissue, practically we have no cicatricial tissue if we get immediate union; at any rate, there is not a zone of cicatricial tissue. Dr. Tiffany stated that my incision takes in half of the corneal periphery. I did not make use of such an expression. I said nearly half and I took it for granted that incisions made by the best operators to-day extend at least over two-fifths of the corneal periphery if they want to bring through a large lens. It is not quite half. The great error in operating often is that the incision is made too small. Dr. Knapp in his descriptions speaks of including practically half the cornea. If Dr. Panas is lucky enough to have very much less prolapsus than others I can only say it will not be long before he will have a series of them which will bring up his average to that of the other operators of the world.

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#### DISCUSSION OF DR. W. H. BAKER'S PAPER, WHICH APPEARED IN THE JUNE NUMBER.

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DR. FRYER.—This matter of heterophoria should be considered as Dr. Bulson said in regard to the correction of hypermetropia and we should consider the work in relation to each individual. It is a fact that a man constantly using his eyes for near work should have in reserve at least two thirds of his muscular power and in giving correction by prism or operation we must remember this. This matter of so called partial tenotomy I insist is a failure. There is no such thing as a partial

tenotomy. As a fact we have in the tendons a most unyielding tissue and unless a tendon is divided entirely there is no effect. It is absolutely impossible to get an effect without the whole tendon is divided, I care not what Dr. Stevens or any other man says to the contrary. I have seen cases in which 12, 14 or 20 so-called partial tenotomies had been done. In the West here most of us are satisfied with one or two at the outside. There are very few patients in the West who will allow more than one or two. The only way you can make a graduated tenotomy is not to separate the tendon from the conjunctiva but to get any effect you must separate the tendon from the eyeball.

DR. COLBURN.—If the question of graduated tenotomy was under discussion I should take issue with the gentleman. I have had occasion to do it quite a few times and I have had a very decided effect, but it must be intelligently done.

DR. ALT.—Do you mean a permanent effect?

DR. COLBURN.—A permanent one. It can not, however, be done without experience. I can look over my earlier work and see where I made many errors in my attempts to do what was called and supposed to be graduated tenotomy, but I know it can be done and in many defects, in fact in every case of strabismus is of great benefit. I have never made what is known as a complete tenotomy. I can get good results with partial or graduated tenotomy and have done so for several years in all my strabismus operations by paying attention to the individual, to the tendon, to the check ligament or the capsule. I know it can be done; I have demonstrated it time and again; the effect of graduated tenotomy is a fact, it is not a fallacy, and its utility is very great. In regard to this I think just as I do as to the correction of small errors of refraction. It must be done with care, with intelligence and after all other means of correcting such cases have been tried. But it has an effect and it seems to me we are belittling our profession when we claim it has not and that we are throwing discredit upon the action of men who have done good service in this field of work. The case related in the paper is certainly very interesting, but it belongs to that numerous group of hysterical cases; the tenotomy may not have had a shadow of influence in it; it may have influenced it to some degree afterwards; the tenotomy may have been done by a man who was not competent

to do it; we can not tell that, but the fact that the patient was better afterwards does not show that the trouble was not corrected to a certain degree. I have seen some cases of strabismus where a complete tenotomy has been made and the eyes put in apparently good condition, where, within a few months, the eyes were crossed again, and cases in which an advancement had been made and in a few months its effect was lost.

DR. FRYER.—What I wish to insist on in regard to the so-called graduated tenotomy is this. Dr. Stevens divides this central part of the tendon tissue leaving two lateral bands attached to the eyeball. These are just as unyielding as the part that is separated, thus you can get no permanent effect. I do not mean to say you can not get a minimum effect, but I say it is absolutely impossible to get any sufficient effect unless the entire tendon is divided.

DR. COLBURN.—Dr. Stevens does not operate that way.

DR. FRYER.—Then he has changed his method as originally described.

DR. COLBURN.—I do not think he has been very clear in his description. Many operators have been very deficient in their work, and I have seen such bad work and have done some myself sometimes, but I know now how to do a graduated tenotomy.

DR. HECKLEY.—Some two years ago I spent two months in Dr. Stevens' office and he described to me how he did the graduated tenotomy, but standing over him I failed to see him do it as he had described it; it looked to me as if he cut the tendon off. In fact, in some case, one day he would do a graduated tenotomy, so-called, and the next day he would cut the tendon off.

DR. BAKER.—I do not think I made any misstatements. I have had experience in graduated tenotomy and I think that the muscle strengthens, and I do not see why it should not strengthen after graduated tenotomy, because cicatricial tissue is formed which is unyielding and by contraction shortens the muscle; I think I am right in that statement.